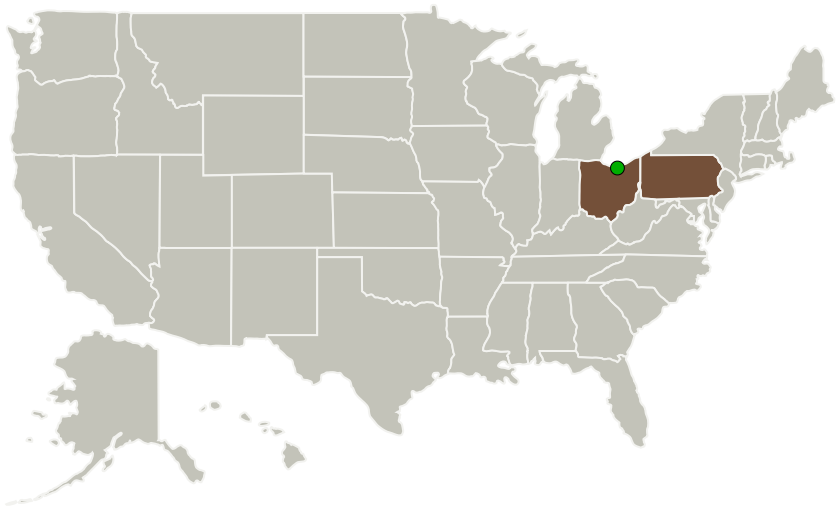
Titanium-Water Heat Pipe Radiator for Spacecraft Fission Power, Phase I

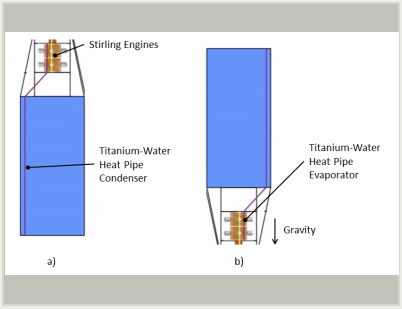
Completed Technology Project (2014 - 2014)

Project Introduction

The proposed program will develop titanium/water heat pipes suitable for Spacecraft Fission Power. NASA is examining small fission power reactors for future space applications with the most recent being Kilopower, which provides roughly 1 kW of electric power. Kilopower uses titanium/water heat pipes to remove the waste heat from the cold end of the convertors. Previous water heat pipe designs for space fission power are not suitable for Kilopower as they are either for surface fission power and use thermosyphons, or are grooved heat pipe designs, which are not suitable for ground testing. ACT will develop heat pipes with two different designs that are suitable for Kilopower: Hybrid grooved/screen wick and Self-venting arterial wick. Hybrid wick heat pipes will satisfy the Kilopower requirements and ACT has already successfully tested similar hybrid wick heat pipes. The self-venting arterial wick has not previously been tested in a vertical orientation but will be investigated as a higher performance, lower mass alternative to hybrid grooved pipes. The overall technical objective of the Phase I and Phase II projects is to develop a titanium/water heat pipe radiator suitable for Spacecraft Fission Power, such as Kilopower. During Phase I, ACT will investigate both a hybrid wick system, utilizing a screened evaporator and grooved condenser design, and a self-venting arterial wick design. The heat pipe design will also include a small NCG charge, which allows the fluid in the heat pipe to freeze in a controlled fashion as the heat pipe is shut down, avoiding damage, and aids with start-up from a frozen condition. In addition to testing the heat pipes in different orientations, freeze/thaw tolerance will also be demonstrated.

Primary U.S. Work Locations and Key Partners





Titanium-Water Heat Pipe Radiator for Spacecraft Fission Power Project Image

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Completed Technology Project (2014 - 2014)

Organizations Performing Work	Role	Type	Location
Advanced Cooling Technologies, Inc.	Lead Organization	Industry	Lancaster, Pennsylvania
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Pennsylvania

Project Transitions

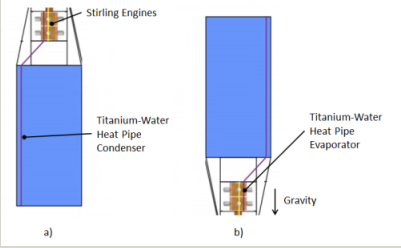
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137340)*

Images



Project Image
Titanium-Water Heat Pipe Radiator for Spacecraft Fission Power Project Image
(https://techport.nasa.gov/image/126932)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Advanced Cooling Technologies, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
William Anderson

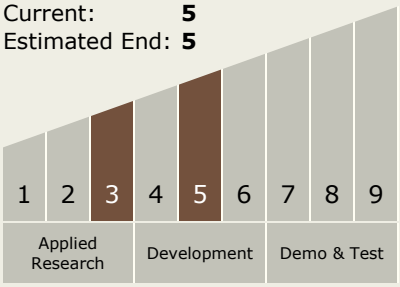
Co-Investigator:
William S Anderson

Titanium-Water Heat Pipe Radiator for Spacecraft Fission Power, Phase I

Completed Technology Project (2014 - 2014)

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.1 Power Generation and Energy Conversion
    - TX03.1.2 Heat Sources

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System